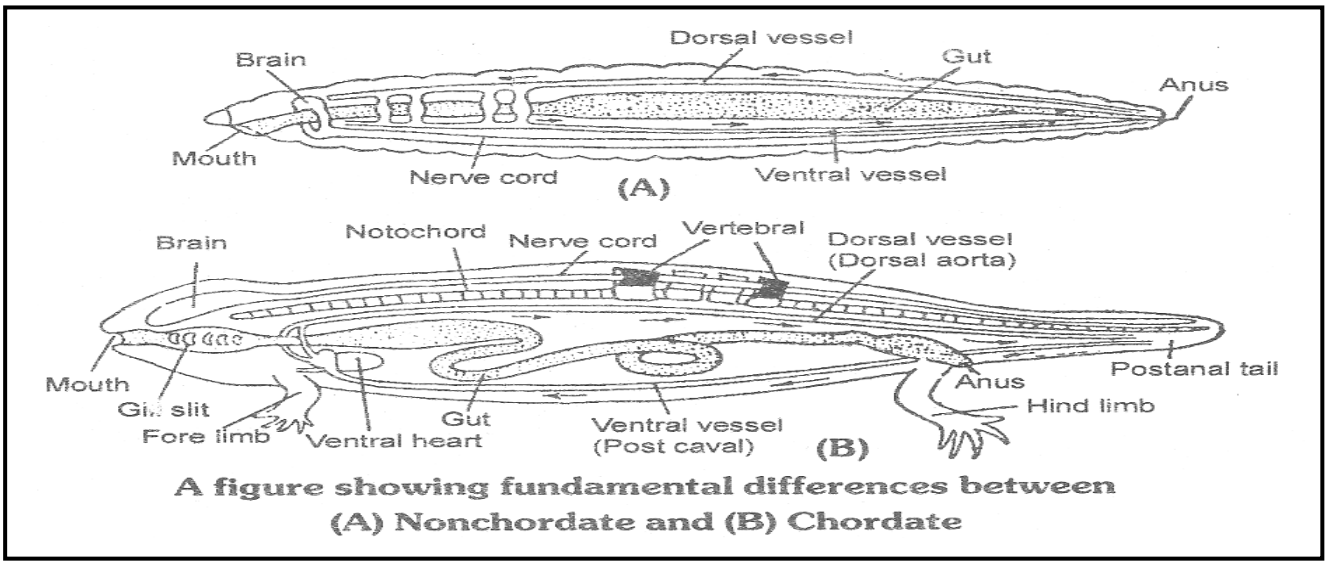
CLASSIFICATION OF CHORDATA PHYLUM

ANIMAL-CLASSIFACTION PROTOCHORDATA TO MAMMALIYA

- Chordates were eveloed during **ordovician** period of **palaeozoic era.**
- The term **"Chordata"** was coined by **"Frances Balfour"**
- The term chordata is originated by teh two words of Greek language the **"Chorda"** and the **'Ata'** Meaning of '**Choreda**' is **'at thick string'** and meaning of **'ata'** is **'to have'** and over all meaning of chordata is animals having **notochord.**
- Notochord suport the body of these animals.
- So, chordates are the animal in which notochord is present in any stage of their life - span.
- Animals, which do not have notochord, are called **non - chordates.**
- According to taxonomists , 90 - 95% **animals are non - chordate** of the total animals present on earth and rest of the **3 - 5% animals are chordates.**
- In chordates, species of maximum live animals is **Pisces group** and minimum live animals is **Amphibia group.**



A figure showing fundamental differences between (A) Nonchordate and (B) Chordate

Three Fundamental Characters of Chordates :

- In all chordate animals, there are some specific character in any stage of their life span, these are caleld fundamental chordate characters.
  These are as follows.

1. **Presence of notochord/Chorda dorsalis :** In the embryonal stage of chordate animals there is a solid stick like strucutre (Just below the central nervous system and abo ve the alimentary canal), this called) **notochord**

- **Notochord** is extended from antirior end to posterior end of the body at the dorsal surface.
- **Notochord** is **mesodermal** is origin. It forms a primary endoskeleton which gives support to central nervous system and muscles.
- In **- Protochordata** group, notochord is present through out the life span but in **vertebrata,** it is modified into **back bone** or **vertebral column** in adults. **Notochord** is replaced by **vertebral column** around spinal cord and Cranium around the brain.

2. **Presence of Dorsal Tubular Nerve Cord :**

- In chordate animals, **nervous system** i situated at the **dorsal surface** of body.
- In these animals, a **hollow, tubular** structure is present which is situated just **beneath the bodywall** and just **aove the notochord.**

- **Nerve cord** is **ecdtodermal** is origin i.e. it is formed by the ectoderm of embryo.
  In **non-chordates,** nverve cord is **solid** and **double** and is situated at **mid ventral side** of body e.g. in **Annelids** and **Arthoropods**
- **Ganglia** are **absent** in the nverve cord of chordates.

3. Presence of pharyngeal gill - clefts :

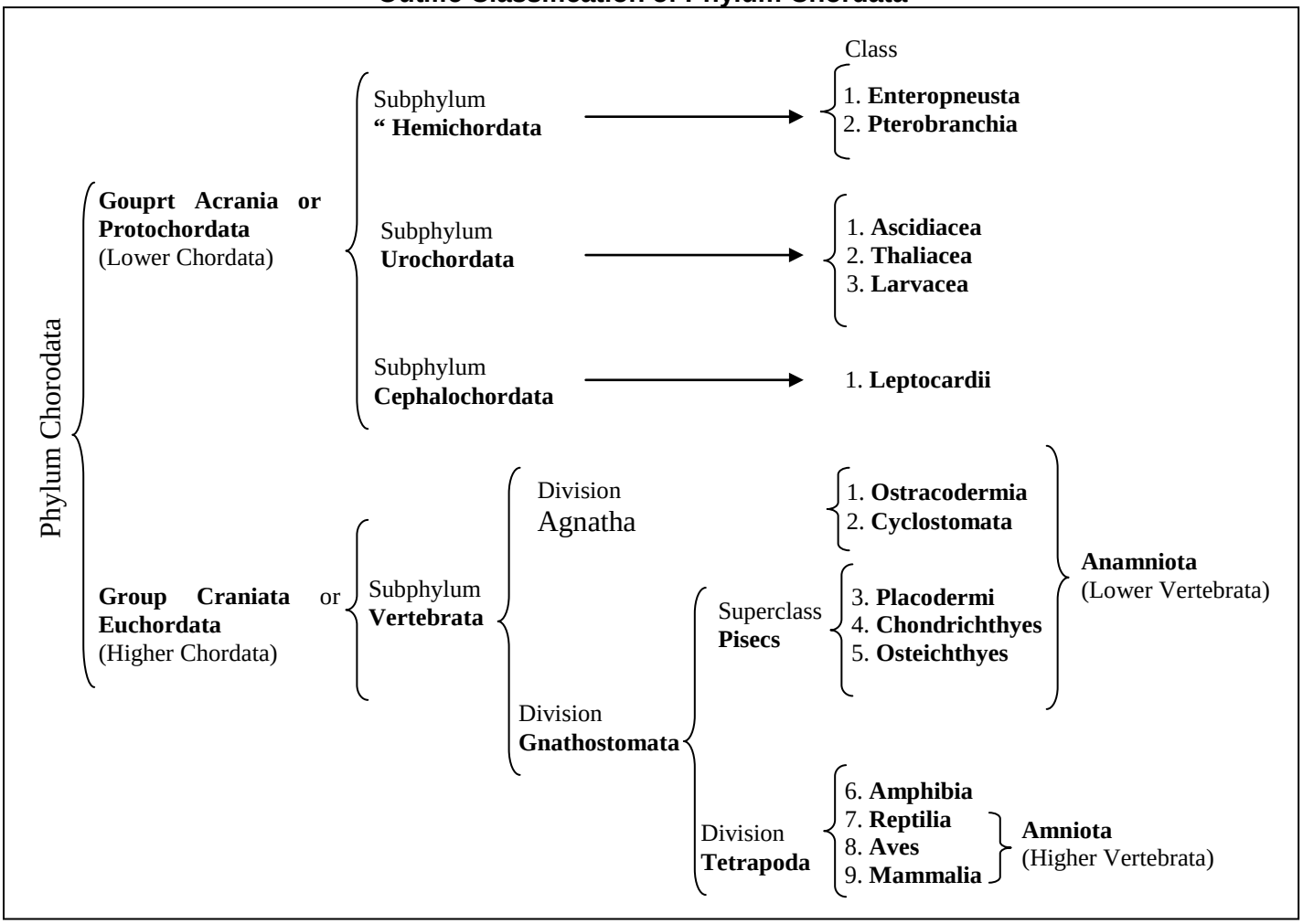
- In each chordate animal, there are paired, lateral **gill clefts** in the walls of pharynx for **respiration** in any stage of its life span.
- In **highger chordate** animals, pharyngeal **gill clefts** are found only in **embryonal stage,** these are absent in adults.
- In **aquatic chordates** (pices) and **lowr chordates,** phyrngeal gill clefts are present **through their life span** for respiration.
- In **terrestrial chordates,** gill clefts are absent in adults, becuase main respiratory organ is **lung** for adults.
- Above three fundamental characters are necessarily found in primary enbryonic stage of chordates, but in adult stage, these are either absent ior modified into other strucutre.
- **Tail :** It is the post anal of the body. Tail is reduced or absent in many adult chordates. It is considered as **fourth character** of **chordates.**

General characters of chordata :-

- These animals are **aquatic, terrestrial** or **aerial,** free living.
- Body is **bilaterally symmetrical.**
- Bodywall **triploblastic,** in which all the three layers **ectoder m, mesoderm** and **endoderm** are present.
- **Metamerism** is found in the arrangement of **muscles in embyonic stage** and in **adults** metamerism is found in arrangement of **vertebrae** and **ribs.**
- True **coelom** si found in them which is **enterocoelous** type, (Deuterostomous animals)
- Alimentray canal and digestive sy stem is **complete,** digestive glands are present and digestion is **extracellular.**
- In these animals, **heart** is situated at the **Ventral side** of body, just beneath alimentray canal and blood flows from **anterior to posterior side** in **dorsal blood vessel.**
- In chordate animals, blood vascular system is **closed** type. Tespiratory pigment is **haemoglobin** present at RBC.
- **Hepatic portal system** is found in **all chordates** but **Renal protal system** also presnet in chordates except **birds** and **mammals.**
- Normally **exoskeleton** is presen, which is highly developed in most of he vertebrates.
- In chordates, **edoskeleton** is found which is made up of **cartilage** and **bones.**
- In **embryonic stages** of chordates a muscular tail is found that is known as **psot anal tail.** I some ☞ Chordates this tail is reduced e.g. man, apes.
- **Proto, meso** and metanephric kidney **are found int eh form of** excretory organs.
- **Sexual** reproduction is **dominant.**
- **Males** are **females** are separate. Metamorphosis or develpment of embryo is **direct** i.e. without any larval stage (few exceptions)
- **Chordates** may be **cold blooded** (Poikilothermous) e.g. **Amphibians, Reptiels** and fishes or **warm blooded** (Hemothermous) e.g. **Birds** and **Mammals.**

CLASSIFICATION OF CHORDATA

Outlife Classification of Phylum Chordata



Phylum **chordata** is divided into **two groups** on the basis of **cranium, vertebral column** and **paired appendages.**

[A] Acrania or **Protochordata** **[B] Craniata** or **Euchorata**

Acrania or Protochordata

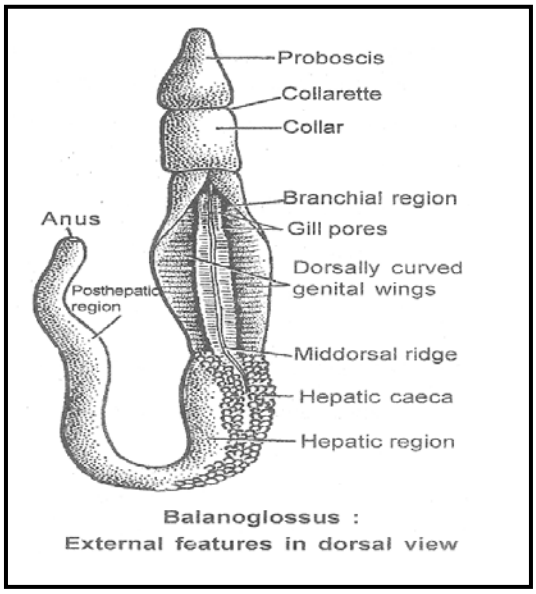
- All the members of this group are small & found in sea water i.e. these are all **marine.**
- Respiration is by **gills.**
- **Pharyngial gill clefts** and found in **embryonic** and **adult stages.**
- **Notochord** persists through out the life, but **skull, brain** and **vertebral column** is **absent** in them.
- Notochord is not replaced by vertebral column.
- **Exoskeleton, head** and **paired appendages** are also **absent.**
- These are **unisexual** or **bisexual** animals. Reproduction is **esexual** as well as **sexual.**
- **Larval stage** is present

Acrania group is divided into **three subphylums :**

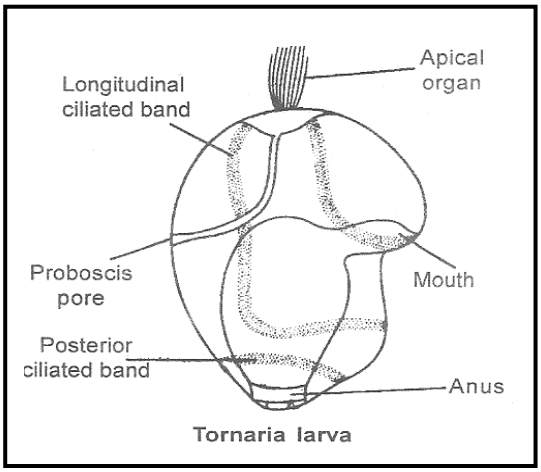
Subphylum - 1- **Hemichordata**
Subphylum - 2-**Urochordata**
Subphylum - 3- **Cephalochordata**

SUB PHYLUM – HEMICHORDATA

- The term Hemichordata was introduced by **Bateson.**
- Animals of this subphylum are all **fosserial,** and their tunnels are 'U' shaped.
- Body **worm like, brittle** and **soft.** Body is divided into **three parts.**
  A - **Proboscis** B - **Collar** C-**Trunk**
- Body wall has **sningle layered epidermis**. No dermis
- Body cavity is **enterocoelus,** this is divided into **Protoceol, Mesocoel** and **Metacoel.**
- Mostly **ciliary feeders.** Complete alimentary canal is present in digestive system. This is **straight** or '**U**' - **shaped.**
- Respiratory pigment **vanadium** is present in their blood. Respire by **gill slits** or body surface
- Circulatory system is open type. Blood is colourless with amoeboid corpuscels. **Heart** is situiated **dorsally.**
- Skeleton tissue is absent and bones are also absent.
- **True notochord** is **absent.**
- A notohord like strucure is found in their **buccal cavity,** that is called **'Buccal diverticulu m'** or **"Stomochord'** (outgrwoth strucutre of gut).
- Post anal tail is Absent.
- **Excretion** is done by a **single glomerulus.** This single glomerulus is situated in teh proboscis known as **Proboscis gland.**
- **Central nervous system** is just **like non chordates. Brain** is present in the form of **nerve - ring.**
- Mostly animals are **unisexual** and reproduction is sexual.
- Fertilization is **external.** Cleavage holoblastic.
- **Development** is **direct** or **indirect** because some animals have **tornaria larva** just like **bipinnaia larva** of echinodermata in their developmental stages.



Balanoglossus : External features in dorsal view



Tornaria larva

Hemichordata is divided into **two Classes**

(1) **Enteropneusta**
e.g.
(a) ***Balanoglossus :*** Tongue worm or Acorn worm
(b) ***Saccoglassus***
(c) ***Protoglossus***

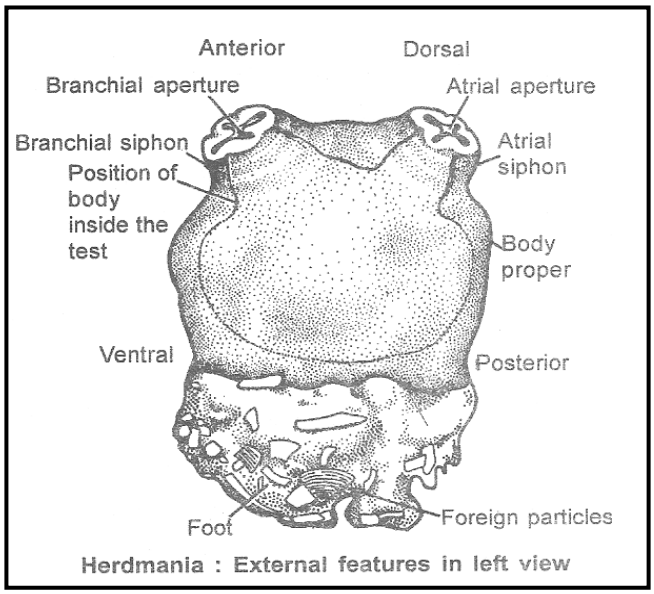
(2) **Pterobranchia**
e,g,
(a) ***Rhabdopleura***
(b) **Cephalodiscus**

- **Modern taxo nomist** to **not** include Hemichordata in **Chordata phylum. Hyman** (1959) kep in **separate phylum** Hemichordata in **invertebates.**

- **Hemichordata is connecting link between Non - Chordata & Chordata.**

SUB-PHYLUM - UROCHORDATA OR TUNICATA

- All the members of this subphylum are marine, free swimming or attached with rocks.
- **Adults** are normally **fixed** and larva is free swimming.
- All the adult members have test all over their body, make up of **tunicin** just like cellulose [tunicine = $C_6H_{10}O_6$] so these animals are also called tunicata. The test is secreted by specific cells of **mesoderm.**
- Metameric segmentation is absent and coelom is also absent.
- Method of tood intake is **ciliary.**
- A cilary glandular silt is present at the ventral surface of phyrynx it is called **endosytle,** it absorba iodine from marine water.
- **Endosytle** homologous to **thyriod gland** of mammals.



Herdmania : External features in left view

- Normally **atrial** apertures and **branchail** apertures are found.
- Blood vascular system is open type heart is situated at **ventral** surface of body. It is tubular and **neurogenic** in nature. Direction of blood flow is changing every time. Respiratory pigment is **Vanadium** in blood which is stored in purpole blood corpuscles knows as **Vanadocytes.**
- Notochord is found only in tail of tadpole larva. Tail is lost during metamorphosis. Chortate characters are found only in the tail region of tadpole larva, so the name **Urochordata** was given to this subphylum.
- Excretion is by **supra neural gland, pyloric gland** and **nephrocytes.**
- Dorsal tubular nerve cord is found in nervous system, which is present only in larval stage. In adult stage, nerve cord is modified into a neural ganglion.
- Most of the animals are bisexual. **Asexual** reporudcito is normaly by **dudding.** Each gonad contains testis and ovary potion (Ovo-testes) in it.
- Fertilisation is external and mostly cross-fertilisation.
- A free swimming larval stage is found in this group, just like tadpole of frog, it is also called **tadpole larva.**
- All the members of this subphylum show **"Retrogressive metamorphosis".** Duting this metamorphosis, a well developed free swmimming larva is changed into ill developed, fixed adult, in these animals larval stage is more developed.
- Only one chordate character is found in adults i.e. pharyngeal gill clefts are found in adults.
  Subphylum Urochordata is divided into **three clases** on the basis of test, atrial cavity, gill apertures and condtiions of life cycle.

Class (a) Larvacea :-

- In these animals some times, larval stage is permanent stage ie. larva does not metamorphose into adult, but attains sexual maturity and reproduces like an adult this conditioin is celled **Neoteny** or **Paedogenesis e.g. :- Oikopleura -** Shows pseudomorphism - A gelatinous sheet envelops this animal.

Which has emergy back door to excapes.

Appendicularia

Class (b) Ascidiacea :-

e.g. :-

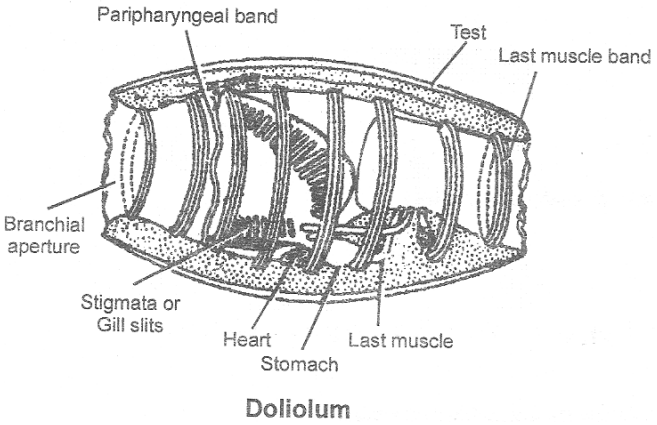
Ref :
- **Herdmania -** Sea - potato or sea - squits
- **Ascidia**
- **Ciona**
- **Molgula**
- **Botryllus**

Class (c) Thaliacea :-

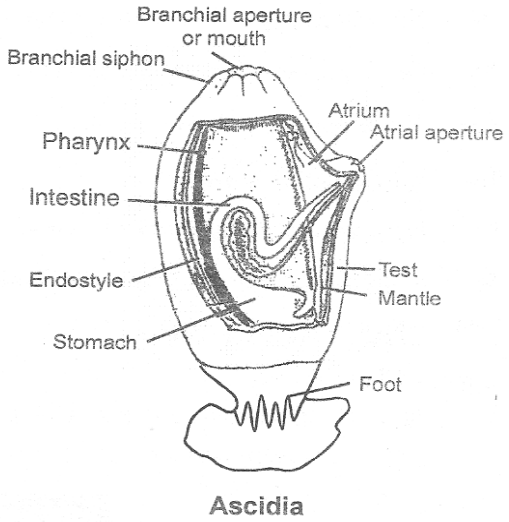
e.g. :- ***Pyrosoma* -** Biofloresence is found. (Strongest ligt among marine organism)

***Doliolum* -** Barrel shaped.

Slapa

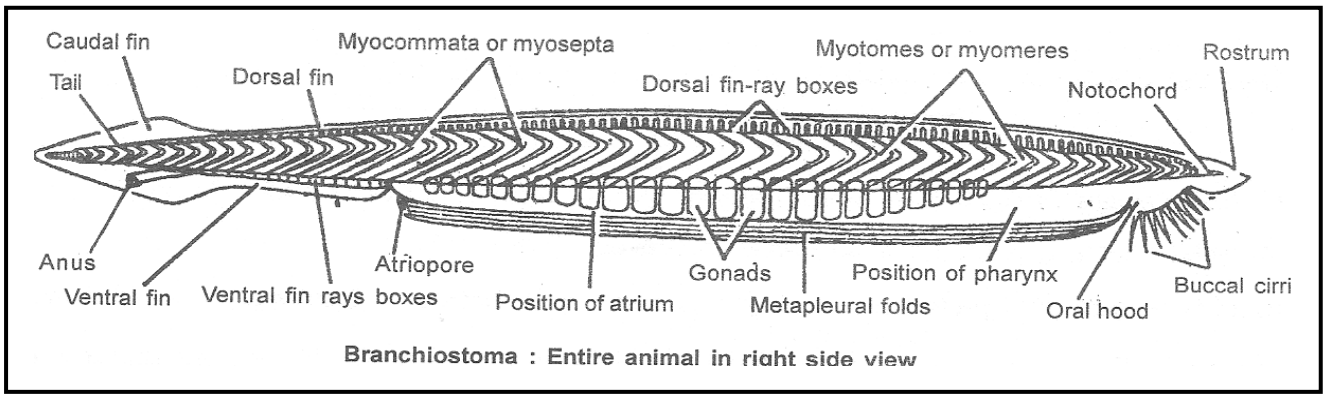


Doliolum



Ascidia

SUB PHYLUM - CEPHALOCHORDATA



Branchiostoma : Entire animal in right side view

- Members of this suphylum ae found in shallow **sea water.**
- Animals form burrows in sand and are noctural.
- Body is laterally compressed like fish, and is segmented.
- Head is absent body is divided into **trunk** and **tail.**
- Paired appendages absent but middle layer fins ae present.

- Alimentray canal **comlete.** Buccal opening is covered by oral hood from all the four sides. Just beneath it, **"Wheel organ"** or **"Ciliated organ of Muller"** present. This organ helps in the ingestion of food by producing circular currents in water.
- **Hatschecks** pit is found on the wall of oral hood which secreates mucus.
- These are **cilliary feeders,** which feed on diatoms and microbes. Oral cirri and velum is present.
- Blood vascular system is **closed type** and respiratory pigment absent.
- Hepatic portal system present.
- For excretion **protonephredia** are present in the form of **flame cells** or **solenocytes. Hatschecks nepheridium** (single) is present which helps in excretion.
- Nervous system is in the form of dorsal, tubular ; hollow nerve cord.
- Notochord and nerve cord remain extended from one end of the body to the other end.
- Fundatmental chordate characters remain through out life. Larva and adult both snow chordate characters.
- These are **unisexual** animals.
- Fertilisation is **external.**
- Development is **indirect** i.e. larval stage is found.
- Members of this group are the **first complete chordate animals**

Class - Leptocardii :-

e.g.:-

(1) ***Branchiostoma*** or ***Amphioxus (Lancelet).*** Also called a ***typical chordate.***

(2) ***Assymetron***

CRANIATA or EUCHORDATA

- These animals are knowsn as **higher chordates** due to the presence of highly developed/advance characters
- These characters include prominatn **head, Vertebral column, Jaws** and **Cranium.**
  Only one subphylum **Vertebrata** is included in this phylum chordate

SUB - PHYLUM – VERTEBRATA

- In these animals, notochord is **completed** or partially replaced by **vertebral column.**
  Vertebral column is made up of so **man certbrae.**
- Brain is covered by a protective covering. It is made up of **bones** or **catilage**, it is called **cranium.**
- There is a prominatn head and a well developed and complicated **brain.** Nerve cord **remaisn enclosed** within the **vertebral column.**
- Animals containing **vertebral column** are included in subphylum vertebrate.
- Different types of exoskeletons are found on the body of these animals e.g. scales, wings feathers hair etc.
- Aniamsl are unisexual.
  Sub-phylum Vertebrate is furterh divided into two divisin.
  (1) Agnatha **(2) Gnathostomata**